PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION

Improvements in or relating to Synchronous Electric Motors of the Squirrel Cage Type

We, THE CROYDON ENGINEERING COMPANY LIMITED, a British Company, of 80, Gloucester Road, Croydon, in the County of Surrey, PHILLIP SYDNEY FIRMIN, of The Shanty, Wallington Green, in the County of Surrey, and CYRIL FREDERICK ERNEST PAYNE, of 133, Alexandra Road, East Croydon, in the County of Surrey, both British Subjects, do hereby declare the nature of this invention to be as follows:—

This invention relates to synchronous electric motors of the squirrel cage type.

In synchronous electric motors of the squirrel cage type the usual method of obtaining synchronism is by forming the rotor core with circumferentially spaced longitudinal channels whereby a number of longitudinal salient poles are constituted between the channels.

These channels, however, have the disadvantage that by uncovering some of the rotor bars they render them ineffective while the motor is at a standstill and thus the starting torque depends on the position of said rotor and there are definite weak spots at which the starting torque is very low. Moreover these channels, in increasing the mean effective air gap, increase the required amount of magnetising current.

It is the object of the present invention to provide means by which these disadvantages will be obviated and a synchronous motor will be produced which will have nearly uniform starting torque and will require substantially no more current than an ordinary non-synchronous motor.

The invention consists broadly in the arrangement that the locking of the rotor at synchronous speed is obtained by forming slots in the rotor core underneath the rotor bars—that is between the rotor bars and the axis—instead of channels in the surface of said rotor core. This causes distortion of the flux path resulting in a high reluctance path for the flux immediately the rotor begins to slip.

Preferably the rotor is divided into a number of longitudinal sections around its axis, equal to the number of poles on the stator, and a longitudinal slot is formed in each section just underneath the bars, the length of the slots depending on the synchronous power required. The slots are of greater width (circumferentially) than depth (radially) and their cross sections curved about the axis of the rotor as centre.

When the rotor is running light the poles of the stator will normally be in common radial lines with the respective slots so that the flux paths will pass symmetrically between the slots. Upon an increase of load the rotor will be deflected backwards with respect to the field and the slots will begin to increase the reluctance of the flux paths until equilibrium is obtained.

For a given value of flux per pole this arrangement requires only a slight increase in the ampere turns per pole as compared to an ordinary non-synchronous motor, as the reluctance of the flux path is only slightly affected by the synchronising slots.

Dated this 20th day of February, 1935.

A. A. THORNTON,
Chartered Patent Agent,
7, Essex Street, Strand,
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For the Applicants.

COMPLETE SPECIFICATION

Improvements in or relating to Synchronous Electric Motors of the Squirrel Cage Type

We, THE CROYDON ENGINEERING COMPANY LIMITED, a British Company, of 80, Gloucester Road, Croydon, in the County of Surrey, PHILLIP SYDNEY FIRMIN, of

[*Price* 1/-]

Price 4s 6d

Price 3s.

The Shanty, Wallington Green, in the County of Surrey, and CYRIL FREDERICK ERNEST PAYNE, of 133, Alexandra Road, East Croydon, in the County of Surrey, both British Subjects, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to synchronous electric motors of the squirrel cage type.

In synchronous electric motors of the squirrel cage type the usual method of obtaining synchronism is by forming the rotor core with circumferentially spaced longitudinal channels whereby a number of longitudinal salient poles are constituted between the channels.

These channels, however, have the disadvantage that by uncovering some of the rotor bars they render them ineffective while the motor is at a standstill and thus the starting torque depends on the position of said rotor and there are definite weak spots at which the starting torque is very low. Moreover these channels, in increasing the mean effective air gap, increase the required amount of magnetising current.

It is the object of the present invention to provide means by which these disadvantages will be obviated and a synchronous motor will be produced which will have nearly uniform starting torque and will require substantially no more current than an ordinary non-synchronous motor.

The invention consists broadly in the arrangement that the locking of the rotor at synchronous speed is obtained, without the use of synchronising grooves in the periphery of the rotor core, by means of holes in said rotor core underneath the rotor bars—that is between the rotor bars and the axis. This causes distortion of the flux path resulting in a high reluctance path for the flux immediately the rotor begins to slip.

In order that the invention may be the more clearly understood an arrangement in accordance therewith will now be described, reference being made to the accompanying drawings wherein:—

Fig. 1 is a somewhat diagrammatic end view of the rotor of a squirrel cage motor in accordance with the invention, showing the relation of said rotor to the rotating field set up by the stator, when the motor is running light.

Fig. 2 is a similar view showing the said relation when the motor is under a heavy load and just about to be pulled out of synchronism.

Referring to these drawings it will be seen from the lines of force that there are four poles on the stator (not shown). The rotor 1 is divided into the same number of (i.e. four) longitudinal sections round its axis, and a longitudinal slot 2 is formed in each section just underneath the bars 3, the length of the slots depending on the synchronous power required. As shown the slots 2 are of greater width (circumferentially) than depth (radially) and their cross sections are curved about the axis of the rotor 1 as centre.

When the rotor 1 is running light the poles of the stator will normally be in common radial lines with the respective slots 2 so that the flux paths will pass symmetrically between the slots as indicated in Fig. 1. Upon an increase of load the rotor 1 will be deflected backwards with respect to the field towards the position shown in Fig. 2 and the slots 2 will begin to increase the reluctance of the flux path until equilibrium is obtained.

For a given value of flux per pole this arrangement requires only a slight increase in the ampere turns per pole as compared to an ordinary non-synchronous motor, as the reluctance of the flux path is only slightly affected by the synchronising slots.

In construction the core 1 is built up in the usual way of a number of disc laminations each of which is formed near its periphery with perforations which constitute holes through the complete core for receiving the copper bars 3. In the present arrangement some or all of the laminations are formed with four additional holes which constitute the synchronising slots 2 extending partly or wholly through the complete core.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A synchronous electric motor of the squirrel cage type, wherein the locking of the rotor at synchronous speed is obtained, without the use of synchronising grooves on the periphery of the rotor core, by means of holes in said rotor-core underneath the rotor bars—that is between the rotor bars and the axis.

2. A synchronous electric motor according to claim 1, wherein said holes are equally spaced around said rotor and are equal in number to the poles of the stator.

3. A synchronous electric motor according to claim 1 or 2, wherein said holes are of greater width (circumferentially) than depth (radially) and their cross sections are curved about the axis of the rotor as centre.

4. A synchronous electric motor substantially as herein described with reference to the accompanying drawings.

Dated this 2nd day of January, 1936.

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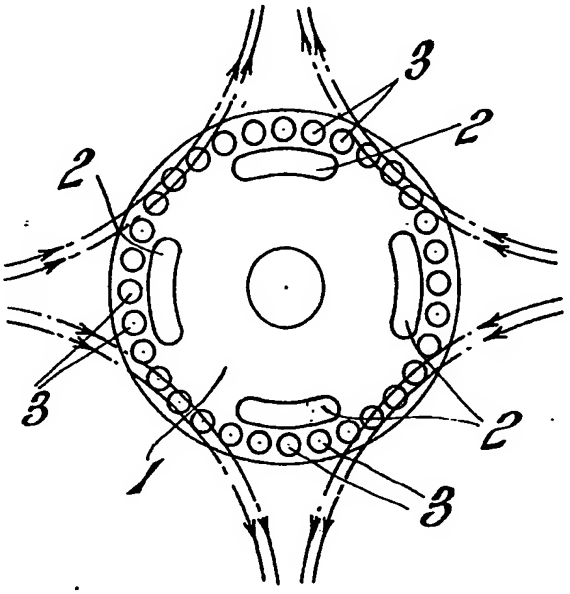

FIG. 1.

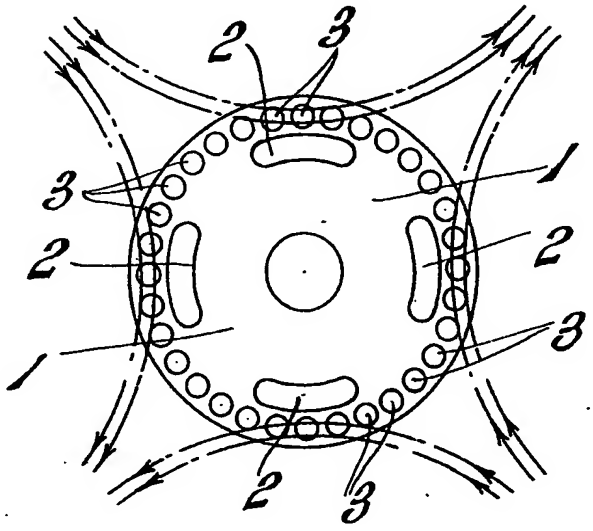

FIG. 2.

Malby & Sons, Photo-Lith.